

PATENT SPECIFICATION



Convention Date (Germany) : Jan. 7, 1937.

Application Date (in United Kingdom) : Jan. 6, 1938.

Complete Specification Accepted : Sept. 22, 1938.

492,579

No. 447/38.

COMPLETE SPECIFICATION

ERRATUM

SPECIFICATION No. 492,579.

Page 3, line 33, *after* " the " insert
" level of the "THE PATENT OFFICE,
January 4th, 1939.

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20 tinuous chemical or other treatment, or
for adjusting the properties or composi-
tion of the liquid by adding another
liquid or other liquids thereto.

A special object of the invention is to
25 mix different quantities of liquids, more
particularly thick or viscid substances,
mixtures, colloidal solutions and the like
with a minimum consumption of energy
compared to the power consumption
30 required in the conventional large mixing
vessels.

According to this invention, the liquids
or batches of liquids to be mixed are split
up into equal portions and the individual
35 portions are delivered into communicating
vessels or reservoirs arranged with their
bottoms at different levels in such a
manner that all portions of one batch of
liquid occupy sections of the vessels,
40 which sections while lying between the
same horizontal planes are at different
distances from the bottoms or discharge
openings of the vessels. After the
different batches have been charged to the
45 vessels, the liquid is continuously or
intermittently tapped off from the bottoms
of the vessels while fresh portions of the
different batches of liquids are fed to the
top of the vessels continuously or
50 intermittently.

The invention will be better understood
by reference to the following detailed
description in connection with the accom-

different levels so that each of the
containers 2, 3 and 4 has a capacity
exceeding by the same amount the
capacity of the preceding container. The
level difference between the bottoms of
two successive containers is such that the
difference in volume corresponds approxi-
mately to the volume of the respective
portions of the batches charged to the
vessels in the mixing process.

The discharge orifices arranged at the
bottoms of the containers are connected to
a horizontal central pipe 9, by the con-
necting pipes 5, 6, 7, 8. The central pipe
9 may alternatively be inclined or may be
arranged in any suitable position.
Inserted in this pipe is a feed pump 10 of
any suitable description, for instance, in
the form of a gear pump.

When starting the mixing process, a
quarter *a* of a batch of the liquid is first
filled into the container 4. Then one
quarter *b* of a second liquid batch is filled
into each of the vessels 4 and 3 and then
one quarter *c* of a third charge or batch
is filled into each of the vessels 4, 3, 2.
The next portion of liquid is then
distributed in four uniform portions I, to
all of the four vessels. The four portions
I are therefore situated between the same
horizontal planes. In the same manner,
the portions II, III, IV etc. of the
further quantities of liquid are distributed
to the four vessels. Now, when tapping

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Improvements in or relating to a method and Apparatus for mixing Liquids

I, RUDOLF ETZKORN, a German Citizen, of 10, Fahrstrasse, Murg, Baden, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a process of mixing liquids and to an apparatus for carrying out this process.

It is the object of the invention to facilitate the mixing of liquids which are produced or become available at different times or places. The invention is especially concerned with the mixing of batches of liquids successively produced in a continuous process, for making up for small differences in the composition of the successive batches produced in a continuous chemical or other treatment, or for adjusting the properties or composition of the liquid by adding another liquid or other liquids thereto.

A special object of the invention is to mix different quantities of liquids, more particularly thick or viscid substances, mixtures, colloidal solutions and the like with a minimum consumption of energy compared to the power consumption required in the conventional large mixing vessels.

According to this invention, the liquids or batches of liquids to be mixed are split up into equal portions and the individual portions are delivered into communicating vessels or reservoirs arranged with their bottoms at different levels in such a manner that all portions of one batch of liquid occupy sections of the vessels, which sections while lying between the same horizontal planes are at different distances from the bottoms or discharge openings of the vessels. After the different batches have been charged to the vessels, the liquid is continuously or intermittently tapped off from the bottoms of the vessels while fresh portions of the different batches of liquids are fed to the top of the vessels continuously or intermittently.

The invention will be better understood by reference to the following detailed description in connection with the accom-

panying drawings, which show diagrammatically and by way of example two forms of apparatus for carrying out the method of the invention. In the drawings:—

Figure 1 is a section through one form of the apparatus,

Figure 2 is a longitudinal section through a modified form of apparatus,

Figure 3 is a lateral section through the distributing device of the apparatus shown in Figure 1.

Referring now to the drawings in greater detail and first to Figure 1, it will be seen that four upright containers or vessels 1, 2, 3, 4 are provided. The containers are cylindrical in shape and uniform in cross section. The bottoms of the four containers are, however, at different levels so that each of the containers 2, 3 and 4 has a capacity exceeding by the same amount the capacity of the preceding container. The level difference between the bottoms of two successive containers is such that the difference in volume corresponds approximately to the volume of the respective portions of the batches charged to the vessels in the mixing process.

The discharge orifices arranged at the bottoms of the containers are connected to a horizontal central pipe 9, by the connecting pipes 5, 6, 7, 8. The central pipe 9 may alternatively be inclined or may be arranged in any suitable position. Inserted in this pipe is a feed pump 10 of any suitable description, for instance, in the form of a gear pump.

When starting the mixing process, a quarter *a* of a batch of the liquid is first filled into the container 4. Then one quarter *b* of a second liquid batch is filled into each of the vessels 4 and 3 and then one quarter *c* of a third charge or batch is filled into each of the vessels 4, 3, 2. The next portion of liquid is then distributed in four uniform portions I, to all of the four vessels. The four portions I are therefore situated between the same horizontal planes. In the same manner, the portions II, III, IV etc. of the further quantities of liquid are distributed to the four vessels. Now, when tapping

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the liquid from the vessels, the level of the liquid in the four communicating vessels sinks practically uniformly so that four portions derived from four different batches in the vessels are mixed in the central pipe 9. For instance, the portions I, II, III and IV of the different batches are distributed over the four containers and thus mixed with each other. On further tapping, the portions II, III and IV of the vessels 4, 3 and 2 will be mixed with each other and with a portion of a fifth batch from the vessel 1. The mixed liquid now may be taken from the central pipe or delivered elsewhere by compressed air acting upon the vessels or the mixing system or by a pump 10. The mixing process may be intensified by a filter arrangement behind the pump 10 or by any other suitable mechanical or chemical treatment.

It will be understood that the process according to this invention is particularly advantageous when carried out continuously, since in this case only a single short starting period, i.e. the introduction of the portions a, b, c, is required, after which all the batches of liquid can be distributed over the four vessels.

A modified apparatus which is suitable for carrying out the process is shown in Figure 2. The apparatus in this instance consists of an exterior substantially cylindrical vessel 11 and cylindrical vessels 12, 13, 14, 15 positioned therein. The dimensions of these vessels are such that the volume between two horizontal planes is the same in the inner cylinder as in the annular spaces between adjacent cylinders. Advantageously, the discharge openings of the individual vessels are coaxially arranged. These discharge openings may be provided with short tubular projections each of which terminates closely above the next lower discharge opening, as shown in Figure 2. In some instances each discharge tube may extend through the discharge openings below it and terminate approximately at the level of the discharge opening of the largest vessel, i.e. the lowest bottom.

The exterior vessel 11 may be formed as a strong-walled pressure vessel, and provided with a heating or cooling jacket, 16, as shown in Figure 2. The vessels 11, 12, 13, 14, 15 may alternatively be of square, rectangular or polygonal cross section, provided that the volume between horizontal planes is the same, as hereinbefore described, in order to enable equal portions of different liquids to be mixed.

The modification shown in Figure 2 offers the advantage, as compared with single separately positioned vessels, as

shown in figure 1, that only the exterior vessel 11 has to withstand the pressure of the liquid, while the interior cylinders 12, 13, 14, 15 may have very thin walls, since the pressure acts upon the walls from both sides so that these interior walls are not subject to the pressure but merely serve to guide the liquid. The hydrostatic pressure and the additional pressure, if any, will act only on the exterior wall. Moreover, only a single heating or cooling device or heat insulating cover is required. Where it is intended to mix different proportions of the different liquids or batches, the cross sections of the vessels may be varied as required.

An automatic feeding device may be used to deliver the liquid proportionally to the vessels, consisting, for instance, of feed pumps, overflow weirs or measuring nozzles corresponding in number to the number of vessels.

Figures 1 and 3 illustrate a distributing vessel with overflow weirs, comprising a chamber 18 into which the liquid or liquids are delivered by a feed pipe 17. The liquid flows over the upper edge of the wall 19 into the four chambers, 20, 21, 22, 23 and is thus delivered to the vessels 1, 2, 3, 4 through the pipes 24, 25, 26, 27. The quantities of liquid delivered into each of the chambers 20, 21, 22, 23 are proportional to the length of the overflow edges 19 of the respective chambers. In order to distribute the liquid equally over the four chambers the overflow edges should be equal in length.

Figure 2 shows a feeding device in the form of a distributing pipe 28 having a number of measuring nozzles 29, 30, 31, 32, 33 which are associated with the vessels 15, 14, 13, 12, 11 respectively, and effect a uniform distribution or a distribution in any desired proportions according to the cross sections of the nozzles.

The novel process and apparatus may be used in many industrial fields for mixing liquid or liquefied substances, for instance, for mixing oil, liquid bitumen, solutions of cellulose or cellulose derivatives, such as for example, solutions of acetyl cellulose of the kind used for making varnishes or lacquers, artificial silks or foils, or mixtures of synthetic fatty acids.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A method of continuously mixing liquids which comprises distributing a batch of one liquid to a plurality of vessels, of which the bottoms are disposed

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- at different levels, in such a manner that all portions of one batch of liquid occupy sections of the vessels lying between the same horizontal planes, distributing a batch of a second liquid to the vessels and then drawing-off the liquid concurrently from the bottoms of the vessels and continuing the distribution of fresh batches of liquid to the vessels.
- 10 2. An apparatus for carrying out the method claimed in Claim 1, comprising a plurality of vessels having their bottoms arranged at different levels in stepped arrangement, pipes connecting the bottoms with each other and with the point to which the mixed liquids are to be delivered and means for successively distributing the component liquids of the mixture to the vessels.
- 15 3. An apparatus according to Claim 2, comprising a plurality of upright vessels of equal cross sections.
- 20 4. An apparatus according to Claim 2 or 3, comprising a plurality of vessels concentrically positioned in a common exterior vessel so that the bottom of the innermost reservoir is at the highest level, and discharge openings in the bottoms positioned substantially coaxially with respect to a common vertical axis.
- 30 5. An apparatus according to Claim 4, in which the discharge pipes in the bottoms terminate substantially at the discharge opening of the next lower bottom.
6. An apparatus according to Claim 4, in which the discharge pipes in the bottoms terminate substantially at the level of the discharge opening in the bottom of the exterior vessel.
- 40 7. An apparatus according to any of the Claims 2 to 6, in which a pressure pipe is connected to the top of the reservoirs.
8. An apparatus according to any of the Claims 4 to 7, in which the exterior vessel is provided with a double wall.
- 45 9. An apparatus according to any of Claims 2 to 8, comprising means for automatically distributing each constituent liquid of the mixture over the reservoirs in the desired proportion.
- 50 10. An apparatus according to Claim 9, comprising overflow weirs or calibrated measuring nozzles for automatically distributing each constituent liquid of the mixture over the reservoirs in the desired proportion.
- 55 11. A method of mixing liquids, substantially as described.
- 60 12. An apparatus for mixing liquids, substantially as described with reference to Figs. 1 and 3 or to Fig. 2 of the accompanying drawings.

Dated this 6th day of January, 1938.

For the Applicant.

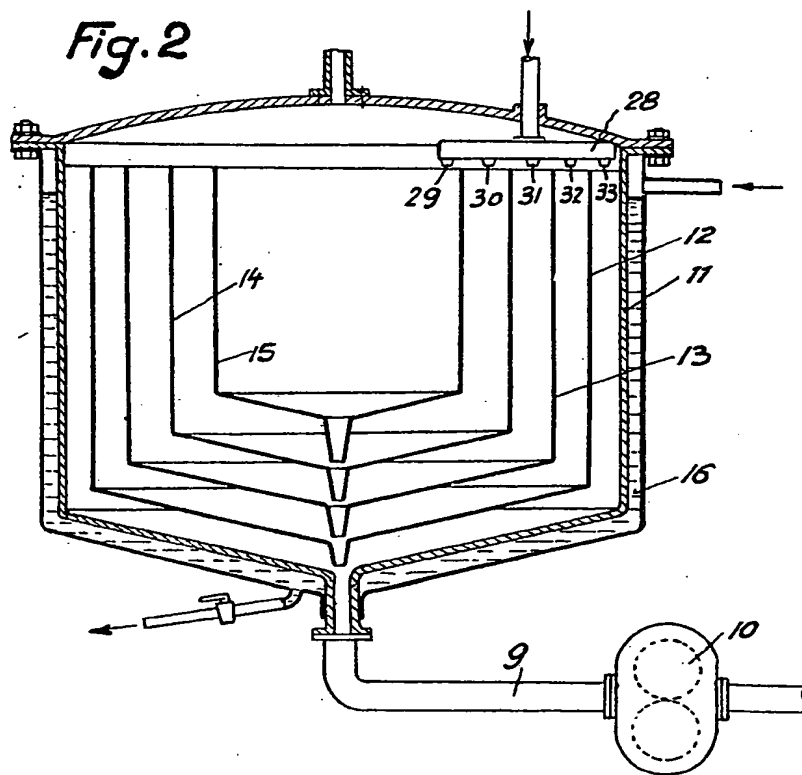
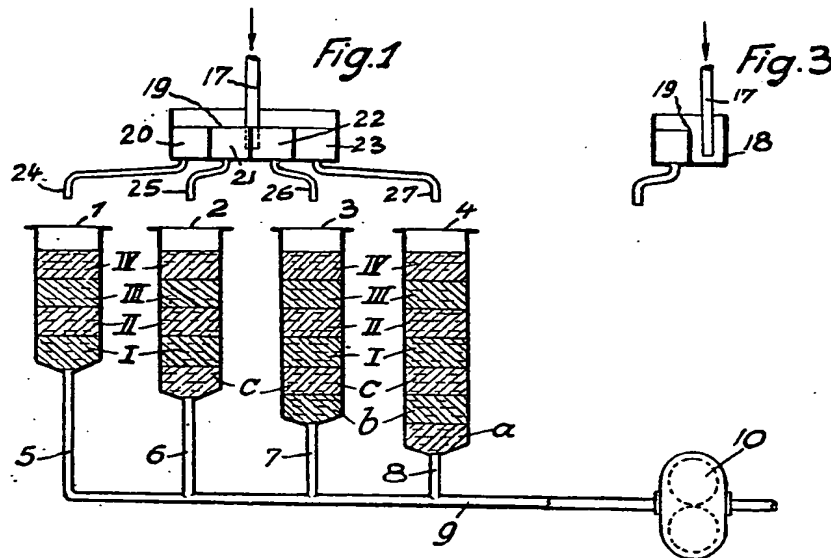
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